

*CALFED Bay-Delta Program Agricultural Water Quality Technical Sub-team
Conference Call Summary
October 10, 1996*

Main Conclusions of Meeting

Key Discussion Items

- Evaluation of water quality actions' parameters list
- Locations and timing of criteria application
- Format for evaluation of CALFED actions

Agreements

- In general, water quality criteria from Ayers and Westcott (1984) will be used as a basis for agricultural water quality criteria. Rather than addressing special cases by generating new sets of criteria, the criteria will be accompanied by a thorough discussion of accompanying assumptions and the implications of these assumptions. Included in this discussion will be the impacts of water quality on leaching fraction and therefore on drainage water volume, of drainage water recycling on future leaching requirements, and the non-sustainability of agriculture when water quality and irrigation and drainage management are not compatible.
- Agricultural water quality standards should be based on the most sensitive crops grown in the region.
- Safety factors for blending of water and in-field variability in irrigation and drainage conditions should also be considered.
- Regulatory and contractual criteria already exist for many locations, and CALFED should not specify criteria that are less stringent.
- The timing of water quality criteria application should be year-round.
- Thirteen agricultural water quality criteria locations were retained. Historical water quality data should be compiled and summarized for the proposed locations.
- The sub-team will limit current input on actions to those affecting parameters of interest for agricultural water supply.

Action Items

- Corrections to the parameters list include that sodium should be replaced by SAR, alkalinity should be replaced with pH, and BOD/COD and metals should be dropped.
- The South Coast hydrologic area needs to be added to the analysis of crop yield sensitivity to salinity.
- A simplified actions list will be prepared and submitted to the sub-team. Sub-team members will provide their estimation of major benefits and constraints associated with each action.

Meeting Minutes

The second meeting of the CALFED Bay-Delta Program Agricultural Water Quality Technical Sub-team was held on Thursday, August 22, 1996 at the Resources Building Room 1142 from 8:30 AM to about 12 noon. *Reference materials included the following:*

- The meeting agenda
- Address/phone/FAX/E-mail list for sub-team members and associates
- Minutes of the July 31, 1996 meeting
- A map of hydrologic regions of California, as defined by DWR
- Maps of water quality monitoring points, irrigation diversions, drainage returns, and maximum salinity intrusion in, as well as legal extent of the Sacramento-San Joaquin Delta
- Revised water quality parameters list, based on July 31 input. Note that metals and BOD/COD should be deleted.
- Listing of crops by acreage in Sacramento River, San Joaquin River, and Tulare Lake hydrologic regions
- Graphical depiction of sensitivity to salinity for major, intermediate, and minor crops
- CALFED Bay-Delta Program Status Report for July-August 1996
- Marked-up list of CALFED actions

These minutes are organized by agenda items, which are shown in bold and italics (*like this*) below. The narrative is a synthesis of discussion at the meeting. Main points, conclusions, and action items are shown in bold (like this).

Item 1: Introductions of attendees

Members of the technical sub-team present were:

Rick Woodard/DWR

Ron Ott/CALFED-CT

John Dickey/CALFED-CT

Lance Johnson/Westlands Water District

Bill Johnston/Modesto Irrigation District

Nigel Quinn/USBR
Terry Prichard/UC Davis
Bob Herkert/California Rice Industry Association
Jim Beck/Kern County Water Agency
Joe McGahan/Summers Engineering
Doug Jones/City of Stockton
Jeanette Thomas/Stockton East Water District

Sub-team associates present were:

Ted Roefs/USBR
Carol Howe/CALFED-CT
Russ Brown/CALFED-CT
Don Wagenet/CALFED-CT
Kristen Ward Brodeur/Consultant

Item 2: Review major points of July 31 meeting

Major points of the **CALFED Status Report** for July-August, 1996 were reviewed.

The status of the sub-team's progress was given, according to the agricultural water quality sub-team's process flow diagram distributed at the first meeting. The team's missions to define agricultural water supply criteria, and to provide expert commentary on CALFED actions to address agricultural water quality issues, were reviewed. The possibility of evaluating actions addressing other (ecological and municipal) water quality criteria was discussed. The sub-team resolved to **limit current input on actions to those affecting parameters of interest for agricultural water supply**, and to reserve input on other actions until such time as they are identified as potentially useful by other sub-teams during joint water quality team deliberations.

Item 3: Mock-up sub-team's final product

The agenda item regarding a mock-up of the sub-team's final product was **deferred until the next meeting**.

Item 4: Water quality criteria

Parameter list (see updated list from July 31 discussion)

Locations for criteria (see in-Delta sampling locations)

Levels (ranges) of criteria (see crop sensitivity information, Ag. Water Quality Goals, Basin Plan levels, historical levels)

Timing of criteria

The following corrections were made to the parameters list given in the August 22 meeting minutes and on the parameters list handed out today:

- **Sodium should be replaced by SAR.** Adjusted SAR should not be used, since SAR adequately predicts the dispersive effect of sodium, which is the principal concern.
- **Alkalinity should be replaced with pH,** since the intent is to identify an indicator of the tendency for plugging by precipitation of calcium carbonate. This occurs at pH > 7.2 if waters contain sufficiently high levels of bicarbonate.
- **BOD/COD and metals were dropped** from the list of parameters of concern.

Ranges of parameter levels given in Ayers and Westcot (1989) were reviewed as starting points for agricultural water quality criteria. In particular, Table 1 was considered. Also, handouts applying the coefficients for modeling salinity effects on crop yield (Table 4; Maas, 1984; Maas and Hoffman, 1976, 1977, and 1983) to crops grown in the Sacramento and San Joaquin valleys and Tulare Lake Basin areas (per DWR hydrologic regions and crop production data) were reviewed. These provide an indication of the percent reduction in crop yield expected as irrigation water salinity increases.

These **guidelines** for acceptable ranges of various parameters (including salinity) **depend on a number of irrigation and drainage management assumptions.** The pertinent assumptions are catalogued in Ayers and Westcot. Some examples include:

- A **15 percent leaching fraction** is achievable and is included in applied water. If this is not the case, then more water or water of better quality is required infrequently.
- **Surface or sprinkler irrigation with adequate drainage** are assumed. Guidelines must therefore be modified for subsurface irrigation (common within the legal Delta), and for situations in which subsurface drainage is inadequate (drainage affected areas in the San Joaquin and Sacramento valleys and Delta).
- A particular, **vertical distribution of water uptake** from the root zone: 40 percent from the top 25 percent of the depth; 30 percent from the next 25 percent of the depth; 20 percent from the next 25 percent of the depth; and 10 percent from the bottom 25 percent of the root zone.
- **Good irrigation and drainage uniformity.** Within-field variability of irrigation

application and drainage was not considered as part of the development of these criteria.

To the extent that these conditions are not met, the criteria may not apply and must be modified. The sub-team resolved to **use the criteria from Ayers and Westcot**, since they are well documented, widely used and accepted, and based on data from California. Rather than addressing special cases by generating new sets of criteria, **the criteria will be accompanied in the report of the sub-team by a thorough discussion of accompanying assumptions and the implications of these assumptions.** Included in this discussion will be the impacts of water quality on leaching fraction and therefore on drainage water volume, of drainage water recycling on future leaching requirements, and the non-sustainability of agriculture when water quality and irrigation and drainage management are not compatible. Terry Prichard will review text prepared by John Dickey.

Other information pertaining to the limitations of criteria included the following:

- Corn has been shown to tolerate some salinization under subirrigated conditions, but eventually requires leaching. After salinization, one study showed that 10 to 15 percent salt removal by leaching that should theoretically remove 50 percent of accumulated salinity. **Therefore, it should be borne in mind that reclaiming salinized land may not be an ideal process.**
- Ayers and Westcot criteria are given according to the level of crop sensitivity. For a given parameter, more sensitive crops require higher quality water. Since conveyance systems mix water delivered to the full range of crops grown in the region, **agricultural water quality standards should be based on the most sensitive crops grown in the region.** For example, strawberry, carrot, and beans require an $EC_w < 0.7$, or $TDS < 450$ mg/L.
- **Safety factors for blending of water and in-field variability in irrigation and drainage conditions should also be considered.**
- **Regulatory and contractual criteria already exist for many locations, and CALFED should not specify criteria that are less stringent.** For example, there are contractual (USBR) criteria for Mendota Pool. Many factors influence this water quality, including upstream drainage inflows to DMC (some undocumented), and the extent of groundwater integration along the DMC.

The locations at which the criteria should be applied were discussed. It was confirmed that the geographic scope of agricultural water use related to the Delta includes all agriculture in tributary regions, and all agriculture in areas whose water supply passes through the Delta. This would include, for example, the Sacramento Valley and Southern California areas receiving State Water Project water for irrigation. **The South Coast hydrologic area therefore needs to be added to the analysis of crop yield sensitivity to salinity.**

The timing of water quality criteria application should be year-round. This is because:

- Irrigation occurs year-round in much of the southern portion of the geographic scope for agricultural water quality criteria application (defined above)
- Pumping into San Luis Reservoir from the Delta occurs year-round, so that Delta water quality at any time of year influence stored water quality.

However, poorest water quality is generally experienced during late summer and early fall, when flows are lowest.

The locations of water quality criteria application was discussed. The list of potential locations in the minutes of the July 31 sub-team meeting was reviewed, and several corrections were made. The following locations and justifications were retained:

Check 9 on DMC. DMC inflow to SWP.

Middle River intersection with Victoria Canal. South Delta water quality.

Rock Slough. CCWD and Byron Bethany service water quality.

Edmonston. Water going south of the Tehachapi Range passes here, and reflects the effects of such factors as groundwater integration via the Kern Water Bank, and inflow from southern tributaries.

Crow's Landing. USBR has data here, and it is a good upstream site for the San Joaquin River.

Vernalis. Long historical sampling record, indicates San Joaquin Delta inflow quality.

San Andreas Landing on the San Joaquin River. Provides indication of San Joaquin River quality downstream of Mokelumne inflow.

Green's Landing. Sacramento inflow quality.

Banks Pumping Station. State Water Project Delta export quality.

Tracy Pumping Plant. CVP Delta export quality.

Three Mile Slough. Western Delta water quality.

Check 13 on the California Aqueduct. SWP water leaving O'Neill Forebay.

Check 20 on the DMC. CVP water arriving at Mendota Pool.

Other points made relative to sampling location included:

- Cross channel opening would influence east Delta water quality
- Delta operations may be driven by municipal water quality requirements anyway

Historical water quality data should be compiled and summarized for the proposed locations. The data summary should separate wet, above-normal, below-normal, dry, and

critically dry years. DWR has much of this data, and Rick Woodard will assist John Dickey in locating it. Acquisition of USBR data for Crow's Landing can be facilitated by Nigel Quinn. The USGS samples at Vernalis.

Item 5: *Actions to address water quality in Delta*

Prioritize/comment on list of actions (see marked-up list from July 31 discussion)

With respect to the list of actions, the following was agreed:

- To **simplify the list**, incorporating July 31 input from the sub-team
- To **delete actions that are redundant, make no sense, or have no impact on agricultural water quality**. These actions should be retained on a list of deleted actions to document the evaluation process.
- To **submit the simplified list to the sub-team** by Monday, August 26. (This date was later delayed by one week to allow for formulation and review of a simplified actions list that will be common to all water quality sub-teams).
- To have **sub-team members provide their estimation of major benefits and constraints** associated with each action. This input will be summarized as the sub-team's evaluation of proposed actions.

Item 6: *Establish following for last sub-team meeting:*

Finalize date and time

List critical agenda items

List information needs

The **next (and final scheduled) meeting of the sub-team** will take place, as previously scheduled, on **Wednesday, Sept. 18, 1996** in Room 1142 of the Resources Building, 1412 Ninth Street, Sacramento.

Based on this meeting, **critical agenda items** will include the following:

- Review and finalize updated materials on agricultural water quality criteria
- Review historical water quality data for proposed locations
- Review and finalize evaluations of actions
- Outline sub-team report
- List critical agenda items for first joint water quality team meeting

Information needs include those cited above during the group's discussion.

References Cited:

Ayers, R.S., and D.W. Westcot. 1989. Water quality for agriculture -- FAO Irrigation and Drainage Paper 29, Rev. 1. Food and Agriculture Organization of the United Nations. Rome.

Maas, E.V. 1984. Salt tolerance of plants. In: The Handbook of Plant Science in Agriculture. B.R. Christie (ed.). CRC Press, Boca Raton, FL.

Maas, E.V. and G.J. Hoffman. 1976. Crop salt tolerance: Evaluation of existing data. In: Proc. International Salinity Conf., Lubbock, TX. Aug. 1976. Pp. 187-198.

Maas, E.V. and G.J. Hoffman. 1977. Crop salt tolerance -- current assessment. J. Irrigation and Drainage Division, ASCE 103(IRZ):115-134. Proceeding Paper 12993.

Maas, E.V. and G.J. Hoffman. 1983. Sensitivity of corn at various growth stages. California Agriculture, 37(7), July-August 1983.